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EDUCATION IN INDUSTRIAL SCIENCE

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AMES, IOWA

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Agriculture
Engineering
Home Economics
Industrial Science
Veterinary Medicine

The Graduate College conducts advanced research and instruction in all these five lines.

Four-year, five-year and six-year collegiate courses are offered in different divisions of the College. Non-collegiate courses are offered in agriculture, engineering and home economics. Summer sessions include graduate, collegiate and non-collegiate work. Short courses are offered in the winter.

Extension courses are conducted at various points thruout the state.

Research work is conducted in the Agricultural and Engineering Experiment Stations and in the Veterinary Research Laboratory.

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EDUCATION IN INDUSTRIAL SCIENCE

A booklet of facts about the courses in Industrial Science at Iowa State College and the opportunities they open to our young men and women.

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AMES, IOWA

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Industrial Science students at Iowa State College

What Is Industrial Science?

COURSES in industrial science at Iowa State College differ from the more purely technical courses, such as engineering and agriculture, largely in the proportions of the science and the technology taught and in the better developed opportunity for specialization in certain subjects. They afford opportunity for men and women to prepare for particular fields of scientific work fundamental to the industries.

Certain sciences are necessarily emphasized in a technical school. Every student who takes a technical course must receive a thoro grounding in several of these sciences. If he studies engineering he must know chemistry, economics, mathematics, physics, and geology; if agriculture, he must know botany, mathematics, economics, bacteriology, physics, geology, entomology, chemistry and zoology. With a foundation in these subjects he is ready to study their applications to the problems of his profession.

But if the student plans to become a specialist in some one phase of science as it applies to the industries, he must choose his courses somewhat differently. The mechanical engineer, for example, must know something of the composition of iron and steel, but he cannot become an expert in steel chemistry without more attention to chemistry than can be given in his engineering course. The student of agriculture must know something of the important insect pests, but he cannot ordinarily fit himself to do systematic work in studying methods of eradicating such pests without much more training in entomology. The young woman who wishes to master the subject of food preservation must have more of chemistry and bacteriology than can be secured in a prescribed course in home economics. Courses in industrial science are therefore planned to allow a student to go further in a science or group of sciences, and still leave opportunity to take such technical and practical work as will help him to know the applications of the science to the problems of the industries.

Opportunity for specialization in the sciences and their utilization has been provided in the following departments at Iowa State College: Bacteriology, botany, chemistry, economics, entomology, geology, mathematics, military science and tactics, physics, comparative anatomy, comparative pathology, comparative physiology and zoology. For those who have adequate training in any one of these fields, there is a real demand. The

Alumni hall is the center of many student activities

various experiment stations, the specialized industries, the federal government, the progressive high schools and the land grant and technical colleges everywhere are demanding scientists, men with fundamental and abundant scientific training.

But it is a particular type of scientist that is wanted, one who has had sufficient practical training to get the viewpoint of the practical man. For example, the man who has specialized in a study of plant diseases can fill a much larger place, prove far more successful and be a far greater good to industry if he is familiar with the more important practices of the horticulturist and agronomist. The entomologist who knows horticulture and farm crops is saved from many a foolish and expensive blunder. The mathematician who has the viewpoint of the engineer, acquired by rubbing elbows with the engineering student in his engineering classes, will be far better able to teach the type of mathematics that technical schools demand.

At Iowa State College there is unusual opportunity for the student to combine "science with practice." Well equipped class rooms, laboratories, libraries and museums enable him to carry on successfully his chosen line of scientific work. At the same time he is not only permitted, but required, to take subjects in the technical departments in agriculture, engineering, home economics or veterinary medicine that will enable him to get a practical bearing for his science and a proper point of view.

Many students who have shown exceptional interest and ability in sciences taught in high school are often unaware of the opportunities open to them in college for a continuation and development of their studies. They are also unaware of the opportunities for work and for positions after graduation from such courses as are given in industrial science. It is not possible to answer here the query as to all the types of positions that may open. In the following pages some of the fields in which there is an actual undersupply of well trained men and women are enumerated under the particular course.

The physical equipment of the college includes nearly 1,400 acres of land, and some forty buildings. Of this land, 125 acres is in the campus proper and the remainder comprises the college and experiment station farms, orchards, gardens and a forestry tract. The buildings provide modern facilities for all phases of the work of the college. The total investment of the state at the college is approximately $4,000,000. The entire faculty, station and extension staffs number nearly 500 men and women, chosen with reference to their special fitness.

Living conditions at Iowa State College are unusually good. The college is remote from the town of Ames and is, therefore, remote from most of the distractions of city life. The student life centers about the campus, famed everywhere for its beauty. The young man who comes to the college comes to conditions that are wholesome and conducive to the best work that he can

Part of one wing of new Science building.

do. He finds plenty of those diversions and entertainments that are worth while. Student activities include all branches of athletics, all under the careful supervision of skilled specialists and with the advantage of one of the largest college gymnasiums in the country and a great athletic field with outdoor equipment. Each year the best music is provided in courses at popular prices. The students themselves provide an abundance of entertainment thru glee clubs, orchestras, debating and amateur dramatics; the various student publications and numerous other organizations give every chance for those side activities which do so much for the development of ability and confidence. In all, the work and the environment at Iowa State College make for the development of strong men and self-reliant women as is evidenced by the notable part its graduates are playing in every field of activity.

Courses That Are Offered

The division of industrial science offers four year courses in the following lines which are described in detail in connection with the account of the department under whose supervision the work is given.

Major bacteriology
Applied botany.
Major botany.
Chemical technology.
Chemical engineering.
Major chemistry.
Major economics.
Applied entomology.
Applied geology.
Major mathematics.
Major military science and tactics.
Major physics.
Veterinary anatomy
Veterinary pathology.
Veterinary physiology.
Major zoology and entomology.
Apiculture.

In addition to the four year courses, the division of industrial science offers in cooperation with the divisions of agriculture, engineering, home economics and veterinary medicine, five and six year combined courses leading to the degrees B. S. A. and B. S.; B. S. in Engineering and B. S.; B. S. in H. E. and B. S.; or B. S. and D. V. M.

In the five year combined courses students enrolled in the division of Industrial Science who have fulfilled certain prerequisites, may, on the completion of their junior year enroll both in industrial science and in the other elected division, thereby receiving two degrees. These courses give the student a more thoro knowledge of the fundamental sciences than the four year courses and consequently enable him to fill better many research, professional and governmental positions.

Because of the larger number of subjects required for the degree of D. V. M. which may not be applied in obtaining the degree of B. S. a six year combined course leading to these two degrees is offered by the divisions of industrial science and veterinary medicine instead of a five year combined course as arranged with the other divisions. This course gives the student of veterinary medicine as thoro a training as that required by the better colleges of human medicine in this country. It will especially train one to fill government positions and to undertake research.

Bacteriology and Hygiene

BACTERIOLOGY is probably the youngest of the sciences, its whole content of fact being a development of the last fifty years. Notwithstanding its newness, however, there is no other science which has done more to revolutionize modern life and industry. It is so fundamental to agriculture, technology and some of the professions that its importance has long been emphasized at Iowa State College where instruction has been given in courses in bacteriology for about 30 years, a record which is unusual.

Bacteriology is popularly thought to relate primarily to medicine. At Iowa State College this relationship is recognized in the applications of the science to veterinary medicine. The problem of increasing the meat supply of the people of America is in a large part at least a problem of disease control. In this the bacteriologist must play his part in the determination of the cause of animal disease, and thru the development of theories of immunity, serum therapy and hygiene point out the path which must be traveled in eradication and control. The problems of personal hygiene and of farm sanitation are intimately related to bacteriology. It is believed that the farmer may know better the how of disease prevention when he knows the why of the precaution he takes.

The field of agricultural bacteriology is a broad one, including as it does the relationship which the bacteria bear to problems of plant food, soil fertility, and soil restoration and conservation, the relationship of bacteria to milk and the changes which it may undergo, the production of butter, of cheese, of cream, and various other dairy products, and the prevention of disease spread through polluted milk; and the relationship of bacteria to food preservation as in the silo.

Students working in a bacteriology laboratory.

Home economics bacteriology is but beginning to be recognized as a subject worthy of emphasis in colleges. The problems of food preservation in the home, canning, problems of house sanitation, family and personal hygiene can be understood only when interpreted and solved by bacteriological aid.

Engineering or sanitary bacteriology determines the standards in determining the purity of drinking water and the disposal of the sewage and wastes from farm and city houses.

Industrial bacteriology, which has to do with the processes of commercial canning, vinegar manufacture, tanning, pickling and the manufacture of various chemicals, is a promising line of endeavor which is just opening up.

The department of bacteriology has several distinct lines of work in addition to the general elementary courses. These are sanitary, household, soil, dairy and veterinary bacteriology. The laboratories in general, sanitary and household bacteriology are housed in the new science building occupied in the fall of 1916. The laboratories in soil bacteriology are housed with the soil department in Agricultural hall while the laboratories in dairy bacteriology are in the Dairy building.

The object of the course offered in major bacteriology is to give fundamental training in general and technical bacteriology such as will fit students as bacteriologists or sanitary experts along the various lines of agricultural, soil, dairy, veterinary, sanitary and household bacteriology. Sufficient technical and industrial work is given in connection with the divisions of agriculture, engineering, veterinary medicine and home economics to round out the course.

There is a consistent demand for men and women trained in bacteriology in its application to the various fields of industry. Positions in the various bureaus of the U. S. Department of Agriculture, the various agricultural experiment stations, engineering experiment stations, college teaching and work on sanitary boards are being created at present at least as rapidly as men are being trained adequately to fill them.

Botany

BOTANY, which is the science dealing with plants, and plant life, means not only the collecting and naming of plants, and the study of their forms and uses, but includes as well a study of the minutest details of their internal structure, of the significance of their resemblances and differences of nutrition, growth, reproduction, and their control, of weeds and their part in the economics of agriculture, of means for increasing the yield of various crops and of the ways of growing new crops on waste land.

As botany is taught at Iowa State College, especial attention is given to systematic botany, which has to do with classification and distribution of plants; plant morphology, which deals with form and structure from the simple organism to higher plants made up of complex tissue; plant physiology, which treats of the behavior of plants under various conditions; plant pathology, which is a study of the diseases of plants and methods of disease control; and economic botany which lays stress upon plants of value for food, clothing and shelter for man.

The botany laboratories are equipped with modern apparatus and an abundance of working material, the department having an herbarium of about 90,000 specimens of which 60,000 are cataloged. In addition there are special working collections for student work, including collections of plants of economic importance to man, weeds, poisonous, good medicinal and fibre plants. The herbarium of grasses is unusually complete and the laboratory for plant pathology is excellently equipped.

The course in applied botany, with properly selected supporting studies, will permit specialization in vegetable pathology, economic botany, physiology, cytological problems in

This greenhouse is used by botany department.

plant breeding, morphology, systematic botany, weeds, seeds and seed testing and ecology. Opportunity is offered in major botany to take special work along botanical lines and at the same time permit the student to obtain sufficient technical training in other divisions of the college to enable him to make

Pot culture experiments are often made by botany students.

practical application of his training in the industries relating to horticulture, agronomy, forestry, and others.

Graduates in botany are trained for the numerous openings in botanical work such as weed problems, plant diseases, physiology, histology, morphology, cytological problems of plant breeding, systematic botany, agricultural ecology. The work prepares men for positions as seed analysts, pure food experts, state botanists, experiment station workers, mycologists, and teachers in colleges in high schools. Plant pathology is a new field just opening up for the trained botanist. Last year it is estimated that $34,000,000 was lost to the farmers of Iowa alone thru destructive plant diseases. Similar losses occur in every state. There is bound to be a demand for men trained in fighting these diseases.

Chemistry

AGRICULTURE depends in a great measure upon the science of chemistry. Liebig, who is considered the father of agricultural chemistry, and his co-workers demonstrated that certain substances called elements are needed in plant growth and that these elements are not always present in soils in sufficient amounts in available forms. This discovery gave a basis for explanation of the beneficial use of manures and brought into existence what is now one of our greatest industries, that of fertilizer manufacture.

In the feeding of animals, practice demonstrated that certain feeds were valuable for the economic production of animals, but it was not until the physiological chemist analyzed them and proved that they contained certain factors which were needed for the growth and maintenance of the animal body that their value was explained. Thus the use of balanced rations was begun. Chemical studies of the animal body are doing much that is aiding the scientific control and treatment of disease.

Chemistry is as closely related to engineering and to the work of the other divisions of the college as it is to agriculture. Since the building of the pyramids of Egypt and the temples of Athens and Rome no greater engineering feats were accomplished until the chemical products, steel and cement, were produced economically. Without these, and without the chemical control of other materials entering into modern engineering, achievements such as great buildings, dams and fortresses would be impossible.

The American public seems but now to have appreciated that the millions of dollars worth of dyes used in America annually can be prepared only by the most highly trained chemists. The same may be said of the $250,000,000 worth of chemicals. But important as these materials are, the manufacture is economically insignificant compared with other industries which make use of chemical knowledge and experience in manufacture and utilization of products.

The corn products industry, using 15,000,000 bushels annually and producing a hundred different products, owes its inception and development to chemists. The chemist has added ten to twelve dollars to the value of every bale of cotton thru his development of the cottonseed oil industry, making a total of $125,000,000 added annually to this agricultural product.

One might continue to point out an almost interminable list of industries, such as sugar, textile, glass, leather, iron and steel, paint and varnish, rubber, packing house, fertilizer, and soap industries, which have benefited almost immeasurably by chemical research and control research.

The department of chemistry is now located in a new building, which is especially well equipped to carry out all types of chemical work. It is the largest building on the campus and one of the largest and finest in the country. Its laboratories are well lighted and ventilated, doing away with practically all disagreeable odors, and are of easy access to the store rooms.

The course in chemical technology trains men to be chemists primarily, and at the same time allows such work to be elected

New chemistry building recently completed.

This chemistry lecture room seats 300 students.

in agriculture and engineering as to give them an insight into the practical application of chemical problems. The student devotes some time to the study of German in order that he may acquaint himself first hand with the great amount of work being done in that country. Drafting, English, public speaking, advanced mathematics and other supporting subjects are required. This training fits one to enter professional life in the capacity of a superintendent of chemical manufacture where the processes involved are highly chemical in nature, as for example, a dye works; or he may enter the government or state engineering or agricultural chemical experiment stations. He may become an analyst and subsequently chief chemist in one of the many great commercial or control chemical laboratories, such as steel works or food products laboratories or he may teach chemistry.

The course in chemical engineering is offered jointly with the division of engineering and has been arranged so that men may be trained in chemistry and yet have enough work in mechanical and electrical engineering to enable them to conduct and devise processes on a commercial scale. Such supporting subjects as English, German, public speaking and commercial subjects, are required. The graduate of this course would be best fitted to enter a large manufacturing establishment whose products depend for the most part on chemical transformations, such as a steel mill or a dye factory. He may become a superintendent of plants and a consulting works chemist, a superintendent of installations of chemical plants, or a manufacturer of chemical machinery. He might take up engineering experiment station work or teach chemical engineering subjects.

A person electing the course with a major in chemistry will receive a much broader training in the general sciences than one trained in either of the preceding courses. This training, however, will not make him as competent a chemist as the course in applied chemistry nor will he possess the engineering knowledge of the chemical engineer. The training may be made to vary with the electives and one will find this course extremely adaptable, especially if he is contemplating master or doctorate work, or teaching work in secondary schools.

Applied Economics and Social Science

The study of man's activities in the ordinary business of life, his means of obtaining his income and his manner of using it constitutes economics. In this day of greater efficiency and more scientific methods in every line of business, the practical value of courses in accounting, statistics and rural or commercial law to all classes of students in a technical institution is generally recognized. The trained agriculturist or engineer is demanding instruction along the lines of transportation, public utilities, and corporate organization and finance.

Such courses as money and banking, public utilities, business law, transportation, rural sociology, marketing or agricultural products, statistics and accounting, are constantly being demanded by the man in practical work.

The department has four distinct kinds of work, rural economics, applied sociology, economics for engineers, and accounting, statistics and business or commercial law. Each line of work has its own professor or instructor in charge. Every effort is being made to adapt economic and social science to the practical needs of technical students in every department of the college.

The foundation course in rural economics is now required of nearly all students in the division of agriculture and the same is true of the elementary course for students in the division of engineering. Social economics and principles of applied sociology are required by the home economics division. Forest economics and business law are required for graduation in the division of forestry.

The course in major economics has been arranged with the cooperation of the other divisions of the College. Students electing this course should take certain subjects in agriculture, engineering, home economics or veterinary medicine, thus affording an opportunity to train themselves as specialists in the fields of agricultural economics, rural sociology, and business engineering. Other lines open are positions as investigators, industrial and rural experts, and teachers in colleges, high schools and secondary institutions of agriculture and technology.

Geology

UPON the investigation of the structure and history of the earth's crust, geology is based. Its business is to interpret the record of the past as that is revealed in the rocks which are exposed to observation on the earth's surface and thoro artificial exploration.

Physical or dynamical geology consists in the study of the chemical composition, and the association of minerals to form different kinds of rock, the decomposition of the strata and the manner in which they have originated and have been altered or disturbed. The stages of the earth's history and the grouping of the strata are regarded as distinct branches and are known as stratigraphical and historical geology.

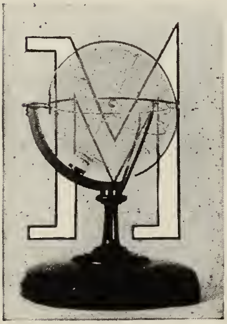
The department museum contains carefully selected series of fossils, minerals, rock, ores, all being available for study purposes. Among the more important collections are the educational series of rocks collected by the United States Geological survey; the Smithsonian collection of rocks and minerals; the Rohn Hodson and Young collections of rocks and ores from the Lake Superior region, the Krantz collection of rocks and minerals, and several other noted collections.

In paleontology, the most important collections are the Calvin collection of paleoozoic fossils; a large collection of coastal plain fossils and the Permo-Carboniferous series from Kansas and Russia. The department also possesses comprehensive series of lead and znc ores; copper and iron ores; copper manganese and silver ores, and lead, silver and gold ores. The laboratory is well supplied with petrographical microscopes and other essential apparatus.

The course in applied geology is designed to meet the requirements of students who expect to make some phase of geology their life work. The course also serves as an excellent foundation for students who expect to specialize in mining engineering, especially the exploratory side of the work; soils survey work, zoology and physical and commercial geography. The course is grounded on elementary mathematics, chemistry, physics and biology. During the last three semesters, students have a choice of subjects which leads toward economic and mining geology on the one hand or toward historical geology and paleontology on the other.

Geology is now recognized as fundamental in the two great basic industries, agriculture and mining, and as a consequence nearly every state and territory maintains a geological survey or mining bureau or both. The federal government maintains a geological survey and bureau of mines. Mining and exploration companies and many of the leading railway companies include one or more geologists in their corps of expert advisors. Many high schools and most colleges and universities include one or more of its branches in their curricula. The supply of competent geologists never exceeds the demand.

Mathematics



MATHEMATICS is essential to every line of applied science. In its subject matter, its study of relationships, its compelling methods of accuracy, the enforced severity of its discipline, and its testing of intellectual power comes close to being an absolute requisite of all applied science.

A thoro knowledge of mathematics is especially necessary to the engineer. It is fundamental in surveying, physics, mechanics, testing of materials, railway engineering, structural design, machine work of every kind, electricity in its manifold applications, and the thousand and one lines into which the engineering of today is differentiated. Two years of mathematics are required in all the leading engineering schools of the country, and the tendency is to increase this requirement.

In agriculture, mathematics is becoming more important as the mechanical side of the farm life is emphasized. The farmer should know about the planning of farm buildings, their lighting and ventilation, and the strength of the materials used; he should have knowledge of the principles involved in the construction and operation of the machinery used in house, field and barn. He should know something of farm drainage and road construction. He should understand the physics of the soil and how to maintain soil fertility. These rest back upon mechanics, surveying, and physics; and these upon mathematics. Advanced agricultural investigation and experimentation, upon which agricultural progress largly depends, is beginning to treat its data mathematically. Thus, a new field of applied mathematics is being opened, in which men well grounded in the fundamental principles and practices of agricultural research, and well trained in mathematics can apply intelligently mathematical knowledge and methods, and can take part in the development of the application of the theory of statistics to agricultural science.

In its higher fields, mathematics probably reaches its maximum usefulness in the aid it renders in the development of physical science. In the leading institutions of the country much graduate research work in electricity and magnetism, sound and light, lines of physical chemistry, bridge stresses, balancing of machines, and applications of statistics to various lines of research is preceded by graduate courses in mathematics selected to meet the particular needs of the investigators. In our technical schools, students have the opportunity of using mathematics as an efficient tool in the development and application of scientific knowledge to the world's varied industries.

The object of the major mathematics course is to train young men and women in mathematics as applied to agriculture, engineering and home economics. A student majoring in mathematics can to advantage minor in physics, chemistry or some line of engineering; or take, as do some young women, the required mathematical work, along with technical and general studies. Students majoring in mathematics and taking the proper supporting studies will be prepared to render service as teachers of applied mathematics or research workers in agriculture, engineering or any one of many lines of science.

Military Training and Tactics

ONE of the provisions of the Morrill Act which made possible the founding of land grant colleges, of which Iowa State College is one, was that Military Science and Tactics was to be taught in return for the aid given by the United States. All male students of the freshmen and sophomore classes, except such as may be excused by proper authority on account of physical disability, are required under this law to take the prescribed course in Military Training. Under the provisions of the National Defense Act the College has secured the authorization and establishment of three units of the Reserve Officers Training Corps: Infantry, Field Artillery, and Engineers. After the completion of the two years basic course, required of all able bodied male students the student may elect two years advanced work in the military department, and upon the successful completion of this work may receive commission as a Reserve Officer of the U. S. Army.

The instruction is given by Officers and Non-Commissioned Officers detailed from the U. S. Army All uniforms and equipment are furnished by the government. The college has recently received an abundant supply of the most modern equipment for the instruction and training of the various units.

Military training gives a young man dignified carrieage of person, a gentlemanly deportment and self-respecting discipline with habits of neatness, order, and punctuality. A carefully prepared course of study covers thoroly and comprehensively the fundamentals of military training, such as discipline, military, courtesy, administration, drill and tactice. It also deals in a general way with the more technical phases of military science. Emphasis is placed on the physical drill; personal hygiene and first-aid form an important part of the instruction.

Recent federal legislation makes it possible for college graduates who have taken certain military subjects to take examinations for appointments as commissioned officers in the Regular

Regimental parade with Agricultural hall in background.

Army. It is becoming almost impossible to secure such appointments without college training. Students with this training may obtain appointments in the Infantry, Cavalry, Field Artillery, Coast Artillery, Ordnance, Signal Corps, or Quartermaster Corps. In addition there are appointments made in the Engineering and Veterinary Corps.

Physics

PHYSICS deals with energy and its transformation. Applications of its principles to processes and appliances are now so numerous and find such widespread use in modern life that the possession of a knowledge of physics by the technically trained man in many instances makes all the difference between success and failure. The extended use of electricity in modern life, its application to lighting, heating, telephone, telegraph and wireless service, the introduction and development of the automobile and the increasing number of mechanical appliances regarded as necessary to comfortable living, have increased the need for training in this science.

The engineer has to deal with applications of the fundamental principles of physics, in the design of structures, in the operation of machinery, the transmission of power and in the construction and operation of the automobile. The principles governing the generation, transmission and transformation of heat are illustrated in the steam engine. Investigations and structural changes involving large expenditures are made in modern office buildings and factories for the purpose of reducing and preventing unnecessary noise. A scientific knowledge of the principles covering sound transmission is necessary to such investigations. The principles of the generation and the distribution of light are applied to the solution of problems in illumination engineering.

The student in home economics finds need of this general knowledge of the subject in the care and operation of the many modern appliances of the home. Students in agriculture have need of the knowledge of the principles of physics, in the work of tilling the soil, in handling crops. and in constructing buildings.

The department occupies fifteen rooms of Engineering hall, including a lecture room, six laboratories, two class rooms, and two apparatus rooms. The lecture room is modern and complete in its equipment. The general laboratories are large and well lighted. The photometry and illumination rooms are equipped with several photometer benches furnished with gas and electrical connections. The arrangement of apparatus is made with a view to facilitating the regulation tests of arc and incandescent lamps and other sources of illumination.

Major work in physics is designed to furnish training for students in the many problems of modern industry which do not fall strictly within the province of the engineer and which are based upon the principles of physics and require for their solution a special knowledge of that science.

The recent development of efficient forms of gas and electric lighting devices, of commercial X Ray tubes, and of wireless telephone apparatus has furnished problems in industrial physics which in most cases have been solved in physics research laboratories maintained by some of the leading industrial corporations. The student is given training in engineering and chemistry as supporting work for this major line.

Research and testing laboratories are at the present time maintained by many gas, electric, and manufacturing companies and by the United States government; these laboratories give rise to a growing demand for men trained in industrial physics.

Veterinary Anatomy, Pathology, Physiology

A student who wishes to pursue work along biological lines may take a major in either of the above departments.

The course in anatomy is an excellent one for those desiring to follow work in teaching or research along general biological lines. Supporting work connected with this special line may be taken in the other biological sciences given in the institution.

Work in veterinary pathology is along the same lines as that given to veterinary students and gives one a thoro knowledge concerning the microscopic and gross anatomical changes in the various diseases of animals. It should be preceded by a course in anatomy and histology. Bacteriology forms an excellent supporting work. This is a worth-while course for those who desire to take up the study of medicine.

To one interested in studying the life functions of the normal animal a major in veterinary physiology is offered. Chemistry and physics form good supporting lines for this work; and there is, perhaps, no other line of biological science which offers as great opportunities as that of physiology. Teachers

Physiology laboratory in the new Science building.

and others who are interested in natural and biological sciences should be particularly interested in this work.

Zoology and Entomology

ZOOLOGY literally means "animal life lore." The work of the science is to formulate and unify the results of particular investigations, in relation to the general theory of life.

The zoological laboratories are well supplied with the usual apparatus. In the way of illustrative material, in addition to the general museum and the entomological collections, there is a large series of charts, models, lantern slides, mounted microscopic slides, skeletons, and alcoholic and formalin preparations.

The general museum consists of specimens selected to show the variation of structure found in the various branches, classes and minor divisions of the animal knigdom. It is rich in representative birds and mammals. In addition to a good series of skeletons, there are mounted skins of about two hundred, and eggs of over two hundred species of birds, and over ninety mounted skins of mammals.

The collection of insects is large, embracing about 60,000 mounted specimens, including a large number of types. There is also a large series of microscopic forms on slides, and a large amount of material illustrating life histories, especially of injurious insects.

The work in zoology is designed, first, to give that knowledge of biological laws, together with the data necessary for their thoro comprehension, which is today regarded as an essential part of a liberal education; second, to furnish the requisite theoretical basis for an intelligent study of certain practical branches of stock breeding, human and veterinary medicine, and economic entomology, including apiculture, which depends directly upon zoological principles; and, third, to impart a knowledge of the facts and methods of investigation in the last of these practical subjects, economic entomology.

In the department of zoology opportunity is given for major work in the fields of morphology, embryology, physiology, entomology, and apiculture. Such practical work is taken in the departments of animal husbandry, horticulture and forestry and in the division of veterinary medicine as will give the student the direct application of this major work.

The work in bee culture aims to fit men and women to fill successfully positions as research assistants and teachers or to operate commercial apiaries. Special work is offered in bee anatomy, the care and management of bees, wintering, queen rearing, bee diseases and apiary inspection and the marketing

One of the reading rooms in the college library.

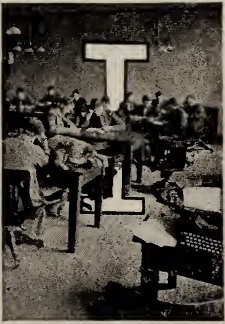
of commercial products. Apiculture offers excellent opportunities for young men with small capital. Competition is slight, and honey always in demand. Annual returns may reach seventy percent or more on capital invested. Experiment stations demand trained apiarists, colleges need teachers, commercial apiaries call for managers, and but few trained men are available.

The work in economic entomology is especially strong and offers an opportunity for specialization in an important and growing field of usefulness. Entomologists are wanted as teachers, as research workers in experiment stations, in sanitary work, in consulting positions with insecticide and spray pump manufacturers, with industrial departments of railroads, irrigation projects, and large agricultural and horticultural interests. A training in economic entomology is one of the important factors in successful county agent work.

Departments Offering Minor Work

In addition to the lines of major work, certain other departments of Iowa State college offer minor work of special interest to the student in industrial science. Work along these lines is necessary in order that the student may secure a well rounded education in addition to training in the special field he is pursuing.

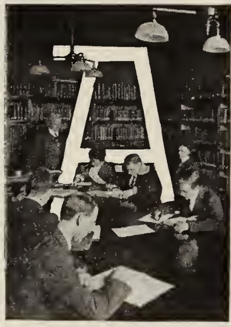
English



IN ORDER that the college student may be able to carry the knowledge which he has to the man who has not had the opportunity of a college education, it is necessary that he know how to speak and write the English language in a correct and forcible manner. If he fails to do this, his faulty expression may be interpreted as a lack of knowledge not merely of English, but also of technical subjects. In conducting business correspondence,, in addressing public audiences of any kind, large or small, in writing reports, bulletins, circulars, or articles for papers or magazines, it is necessary that the college graduate know how to express his ideas not only clearly and correctly, but also forcibly.

A knowledge of the formal rules of grammar and composition is not sufficient; he must know how to think clearly and readily and to express his thought with facility and ease. To help him gain this power the teacher of English must point the way to clearer, more forcible expression. The student who has acquired the power of thinking logically and of expressing his thought effectively, may find his English no less valuable as a tool than his knowledge of technical subjects.

History



ANY INSTITUTION of technology like the Iowa State College must deal with all phases of industrial and social efficiency, and with the numerous social and economic questions which are connected with industry on the one hand and agriculture on the other. These questions cannot be clearly understood except through the application of the historical and comparative method of study and investigation.

In order to meet this need, the department of history offers two general courses which are followed by a number of specialized courses in economic history. These courses have been adapted to the needs of technical students in all departments of the institution.

The industrial history of the United States, for example, presents the basic facts in the economic development of the country; the economic history of American agriculture presents a study of those topics which are of primary interest to the student of agriculture. The West in American history, a course designed primarily for home economics students, aims to trace the influence of western ideas on the economic, social, and political evolution of the nation.

The work of the department is intended to provide well arranged courses of instruction for students in all divisions of the college, the chief aim being to give such historical knowledge and training as will enable men and women to think intelligently on present day problems and to become useful American citizens.

Psychology

A knowledge of the fundamental principles and laws of psychology, which condition directly the behavior of the individual, is essential in every phase of life. The aim is to emphasize the fundamentals of the science; and to establish the habit of psychologizing. The result is that the student is better fitted to

Corner of psychology library and laboratory.

cope with the problems of life. The psychological principles which a business man should know are emphasized and applied to advertising, and increasing human efficiency. The psychology of such movements as the boy scouts, the girls' camp fire, cooking clubs, corn judging contests, is considered; the mind of the animal is studied; and the various phases of the subject are applied to education. Such headings as "the mind of the crowd," "public opinion," "custom" and "fashion," indicate the application of the subject to various phases of economic and social life.

Library

THE COLLEGE library contains about 80,000 cataloged books besides several thousand uncataloged pamphlets. About 1,000 periodicals are currently received, not including annual reports, year-books, government documents, and irregular continuations. The library is a government depository library and regularly receives all publications sent out by the United States government. The library is especially strong in current, technical, and scientific journals, and a great effort is being made to complete the files of back numbers. The college library consists not of a single collection of books but of a system of libraries as follows: General library, agricultural library, botany library, chemistry library, engineering library, and veterinary library.

The general library, housed in Central Building, is the nucleus of the system and contains the largest collection of books on the campus. This collection covers all fields but is specially adapted to the needs of students in science and the applied arts. Here may be had all general reference books and collections of works on literature, history, economics, sociology, home economics and scientific books of a general character. The department libraries are permanent collections of technical books, special periodicals, and transactions of societies relating to the work of the particular collection to which they belong.

Public Speaking

Many college students take up work which requires that they know how to present their ideas in a clear, interesting manner. Teachers, county agents, and extension workers for instance are constantly required to speak before audiences. Engineers must present plans orally before boards and argue for their adoption. Business men many times must present a proposition personally. For men in these lines of work, ability to speak forcefully is a valuable asset. This ability the public speaking department develops. In addition the members of the department coach the class and dramatic club plays. Society debates, oratorical and

No football game or pep meeting is complete without the band.

declamatory contests give opportunity for extra practice. Debates are held each year with some of the leading colleges of the middle west.

Music

MUSIC has been made an integral part of student life by the department of music at Iowa State College thru the institution of a number of classes in music-study. These are held regularly and college elective credit is given. The work of the department of most interest to the general student body is that of the bands, orchestra, glee clubs and chorus. The two bands of 42 pieces each play at all athletic games and important student activities. One band forms a part of the military department. The men's glee club and the women's glee club present home concerts and also tour this and adjacent states during vacations. The chorus sings at Sunday Chapel services. Programs are given by the college orchestra during the school year.

The music council provides a series of concerts each year by the world's greatest artists and offers them to the public at an extremely low price of admission. Some artists who have appeared on these programs recently are Louise Homer, Pablo Casals, Madame Schuman-Heink, Madame Gadski, Mischa Elman, Anna Case, Josef Hofman, the San Carlo Grand Opera company and the New York Symphony orchestra.

Modern Languages

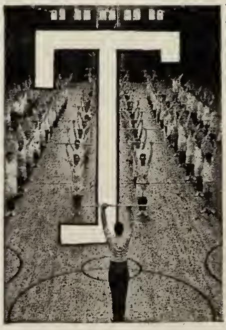
FOR the technical student, knowledge of foreign languages is essential. Much of the best things being published today in scientific literature appears in French or German. While much of this later becomes available in good translations, it may be considerable time before the article or book that is needed most is made usable. The men who stand at the top of the technical professions are able to keep abreast of what is going on in their line by reading the foreign books and periodicals as soon as they come out. They usually do not have

State Field when the big football game is on.

time to oblige their less fortunate competitors by stopping their own work to make translations. The crisp facts have their main value for scientists only in the fresh, untouched expression of the original.

In the changing trade conditions of the world, a knowledge of Spanish will be of greatest value with the agriculturalist or with the scientific worker. As business relations with South American countries grow, there is likely to come a call for graduates from American technical schools to take places as teachers and investigators in South American universities. The graduate with a knowledge of Spanish will be the one to get the first call. The same is true of the Philippine Islands.

Physical Training



THE WORK in the department of physical training includes studies in personal hygiene, systematic gymnastic exercises, indoor and outdoor sports, and competitive athletics. The department believes that its work should be mainly with the many rather than with the few, and that the development of special teams is of secondary importance as compared with the development of the student body as a whole. Interclass and intercollegiate contests are deemed desirable under proper restrictions, but their importance is not exaggerated.

The regular work of the department consists of lectures on hygiene, physiology, anatomy, and kindred subjects; drill in marching floor tactics, and class evolutions; class and individual drill in general calisthenics with and without apparatus, and mat exercises; class work in general indoor and outdoor athletics; corrective exercises for any who are defective physically; and incidentally, specialized individual and team work in football, basketball, baseball, track, cross country, tennis and wrestling.

The department is well equipped for both indoor and outdoor work. The gymnasium recently completed is 297 feet long and 83 feet wide and is one of the largest in America devoted to physical training. The main exercise floor is eighty feet by one hundred and seventy feet. It is equipped for basketball, indoor baseball, volley ball, and hand ball, and has a gallery running track twelve feet wide, with twelve laps to the mile. The lower floor is of dirt and is used for general exercise, field and track work, and team practice. The building is equipped with a swimming pool thirty feet wide and sixty feet long; there are general and team locker rooms with all the necessary bath and toilet facilities. It is well lighted, both naturally and artificially, and has forced ventilation thruout. In addition, the department has at its disposal the new athletic field containing ten acres, directly south of the gymnasium; a playground to the north of the gymnasium of about equal area; and the old athletic field containing about seven acres. These fields are fitted out for football, baseball, soccer, tennis, track, and field work.

This men's gymnasium is 297 feet long and 83 feet wide

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Entrance Requirements

Entrance to Iowa State College is based on the standard for the three state educational institutions. Applicants for admission to the freshman class should be at least 16 years of age, and they must present at least 15 units of high school work. An entrance unit is defined as 36 weeks of high school work in one subject of study with five class periods per week, each not less than 40 minutes long; each laboratory period should be at least 85 minutes in length. Of the 15 entrance units certain are required and the remainder may be elected.

For admission to the division of engineering the required units are: English, 3; history-civics-economics, 1; mathematics, 3, with 1½ in algebra and 1 in plane geometry and ½ in solid geometry; additional units in English, history-civics-economics, mathematics and the natural sciences 4 units; electives, 4 units; total, 15 units. In English the total units offered may not exceed 4; in history-civics-economics, 4; foreign language, 4. In natural science, the student may offer not to exceed 4 ½ units; his units may be distributed among the various scientific subjects as follows:

Agriculture	½ to 2 units	Physics, not less than	1 unit
Astronomy	½ unit	Physical geography or physiography	½ to 1 unit
Biology, elementary	½ to 1 unit	Physiology	½ unit
Chemistry, not less than	1 unit	Zoology	½ to 1 unit
Geology	½ unit		

As electives the applicant may offer not more than ½ unit in advanced or commercial arithmetic; ½ to 1 unit in double entry bookkeeping; ½ unit in commercial geography; ½ unit in commercial law; ½ unit in industrial history; 1 unit in stenography and typewriting; ⅛ to 2 units in mechanical or freehand drawing; ½ unit in psychology.

A student who presents 14 accepted units may be conditionally admitted to the freshman year but the entrance condition must be removed one calendar year after his admission.